

A Comparison of RUC-derived and RAP-derived CIP and FIP Icing Products

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1. Introduction

- CIP & FIP algorithm output is a valuable source of supplemental analysis and forecast information for in-flight icing conditions.
- The operational RUC model, previously the base model for the CIP and FIP algorithms, was replaced by the WRF Rapid Refresh (RAP) model, requiring adaptations to the algorithms.
- The QA PDT was tasked to quantify the degree of similarity and difference between RUC-derived and RAP-derived CIP & FIP algorithm output prior to operational implementation of the RAP model.
- New CIP & FIP algorithms based on RAP have been running operationally at the Aviation Weather Center since May 2012.

2. Verification Approach

1) Spatial coverage and production

Determining the extent to which significant levels of *probability, severity, and SLD* are present at the same location and frequency of occurrence.

2) Production over a range of values

Measuring the overall similarity of algorithm attributes by comparing distributions of thresholded and binned fields.

3) Grid averages, agreement, correlation, error

Assessing the level of agreement, correlation, and error (differences) through grid-to-grid comparisons.

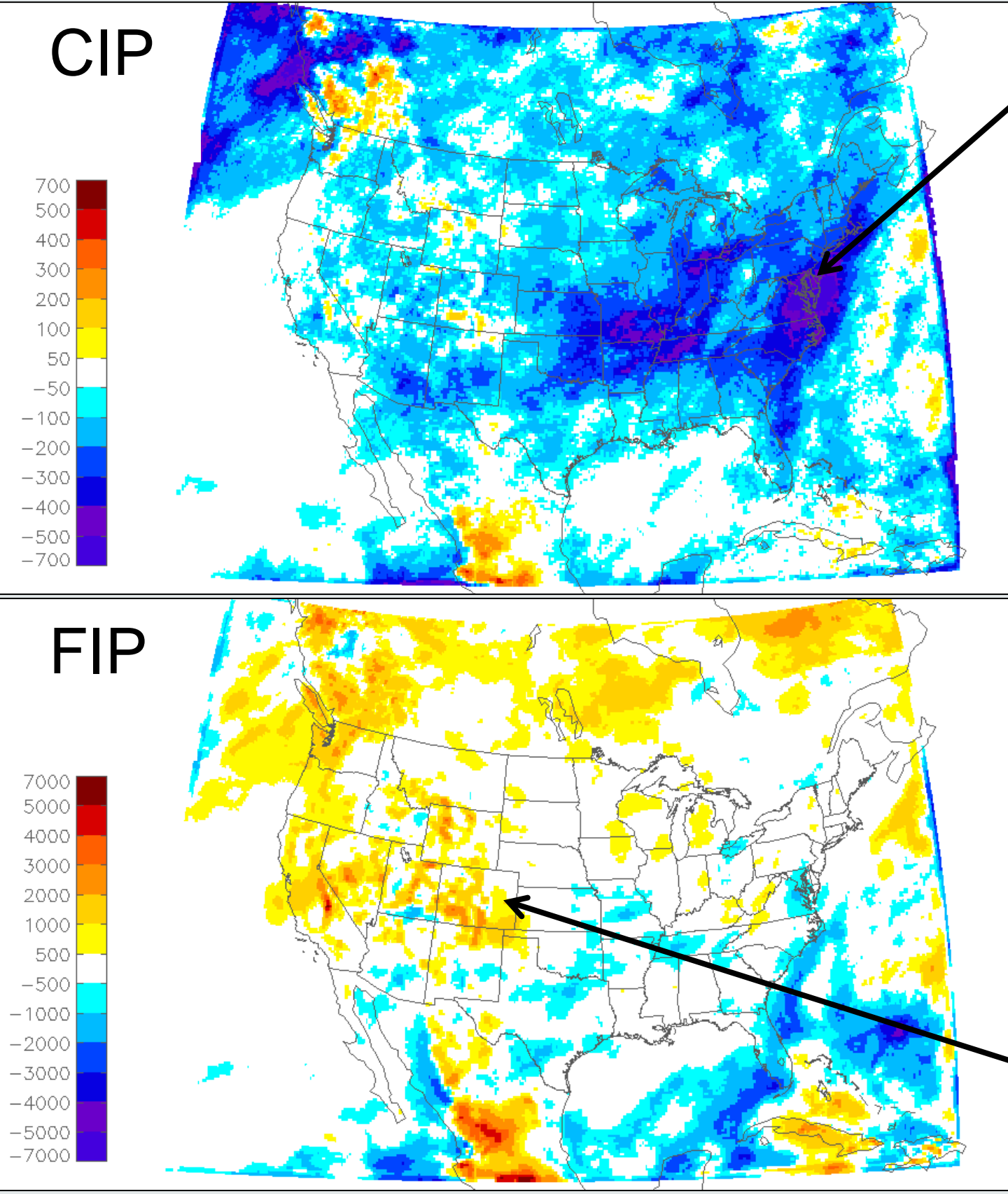
4) Skill assessment vs PIREPs

Comparing algorithm severity (masked by probability field) to truth data (PIREPs), to assess whether differences in algorithm output are accompanied by differences in overall skill.

3. Results

A. Probabilities

The following three sets of figures consist of (RAP – RUC) difference maps.



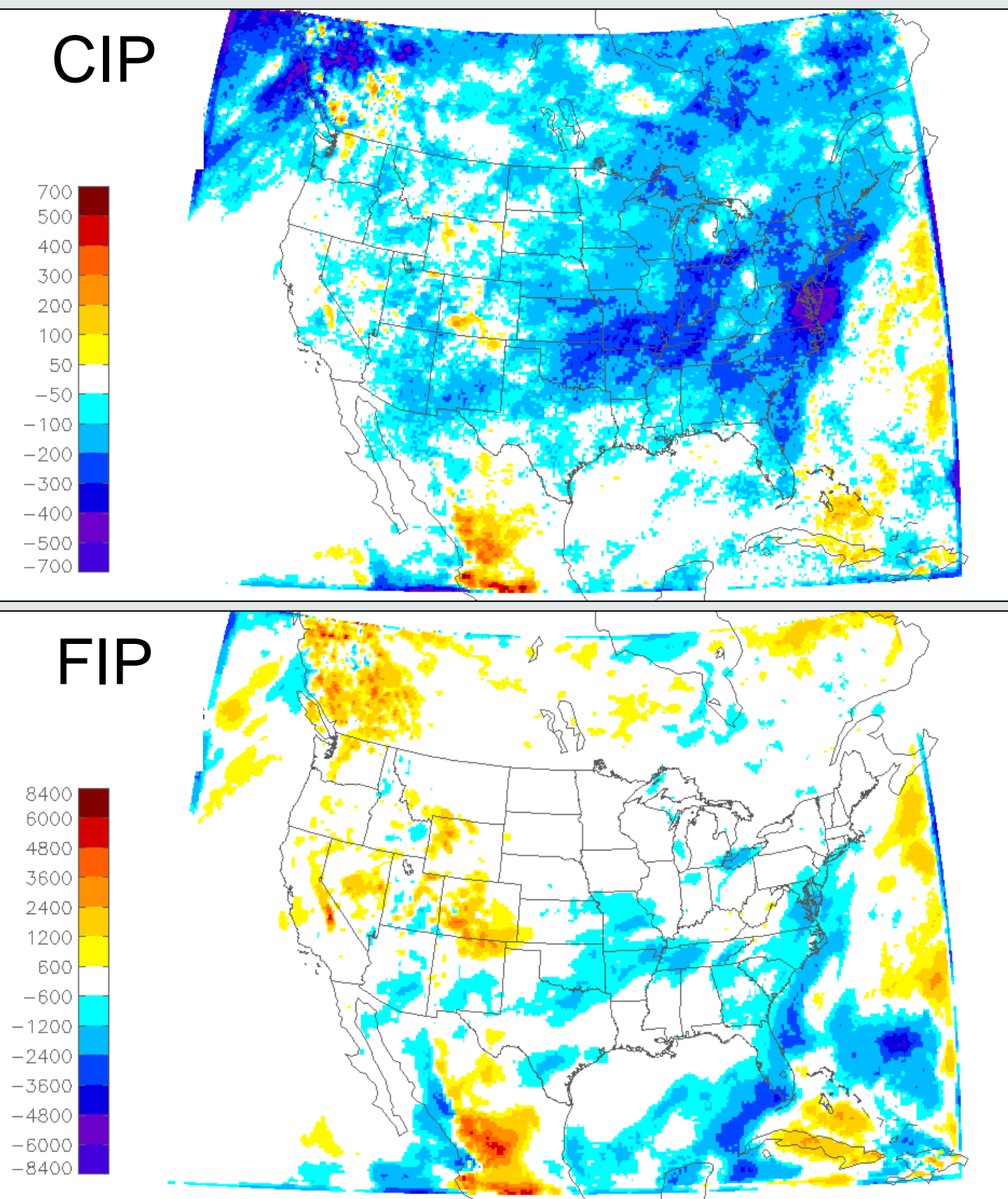
RUC > RAP

CIP probabilities greatly reduced with RUC to RAP change.

FIP probabilities increased slightly.

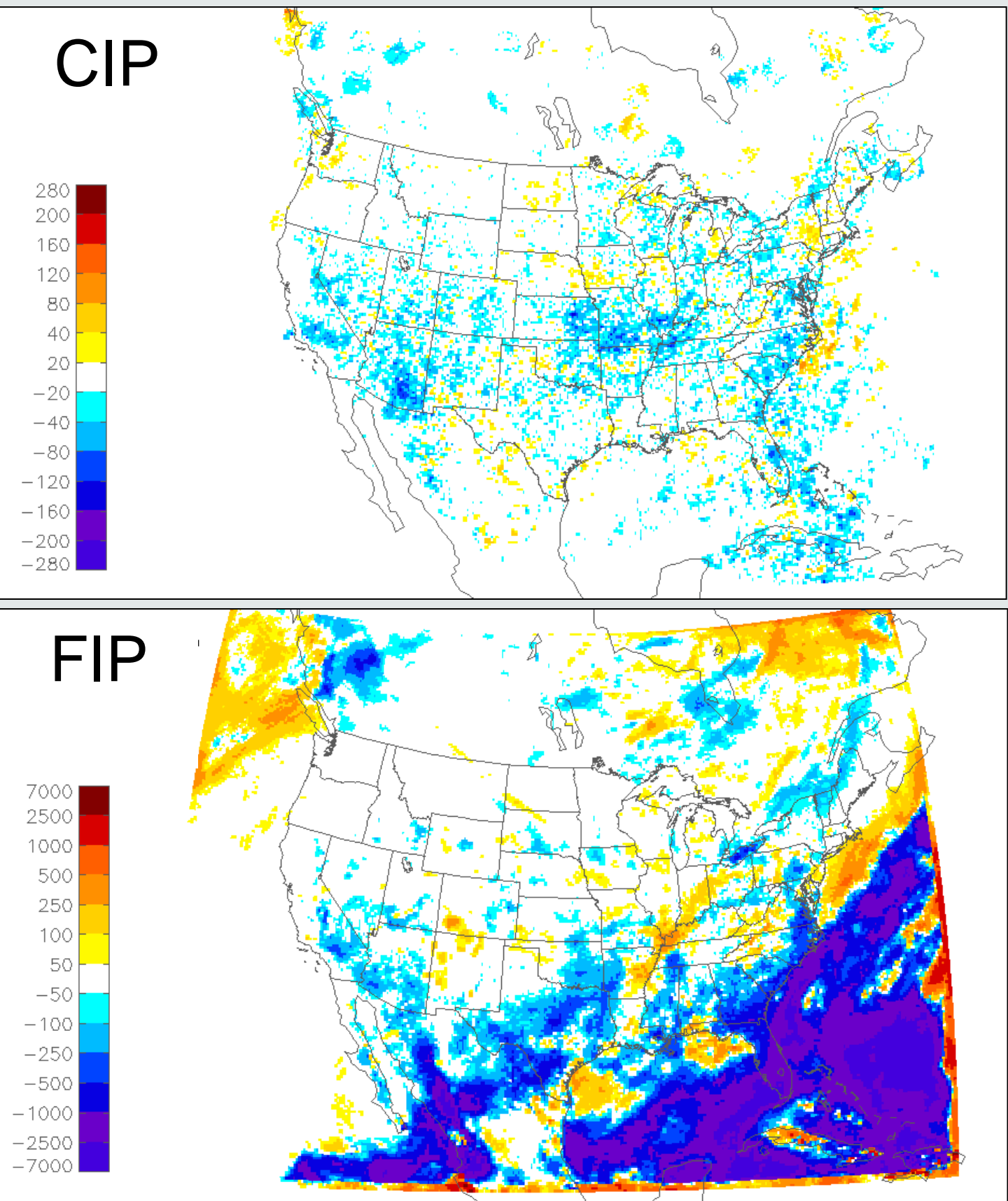
RAP > RUC

B. Severity



Changes in severity fields for CIP and FIP very similar to the changes in the probabilities

C. Super-cooled Liquid Drops (SLD)

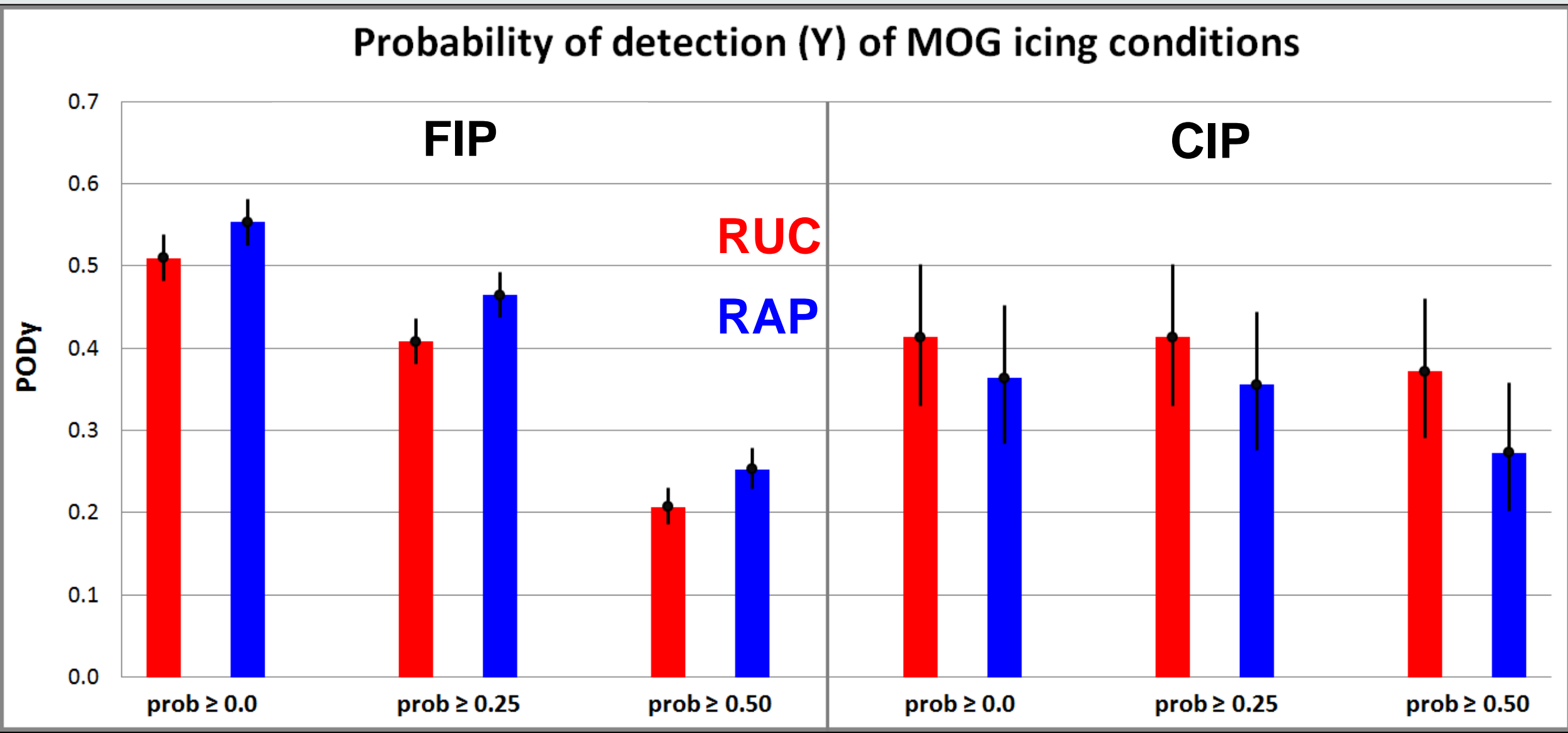


Low magnitude differences; uncorrelated with probability and severity fields.

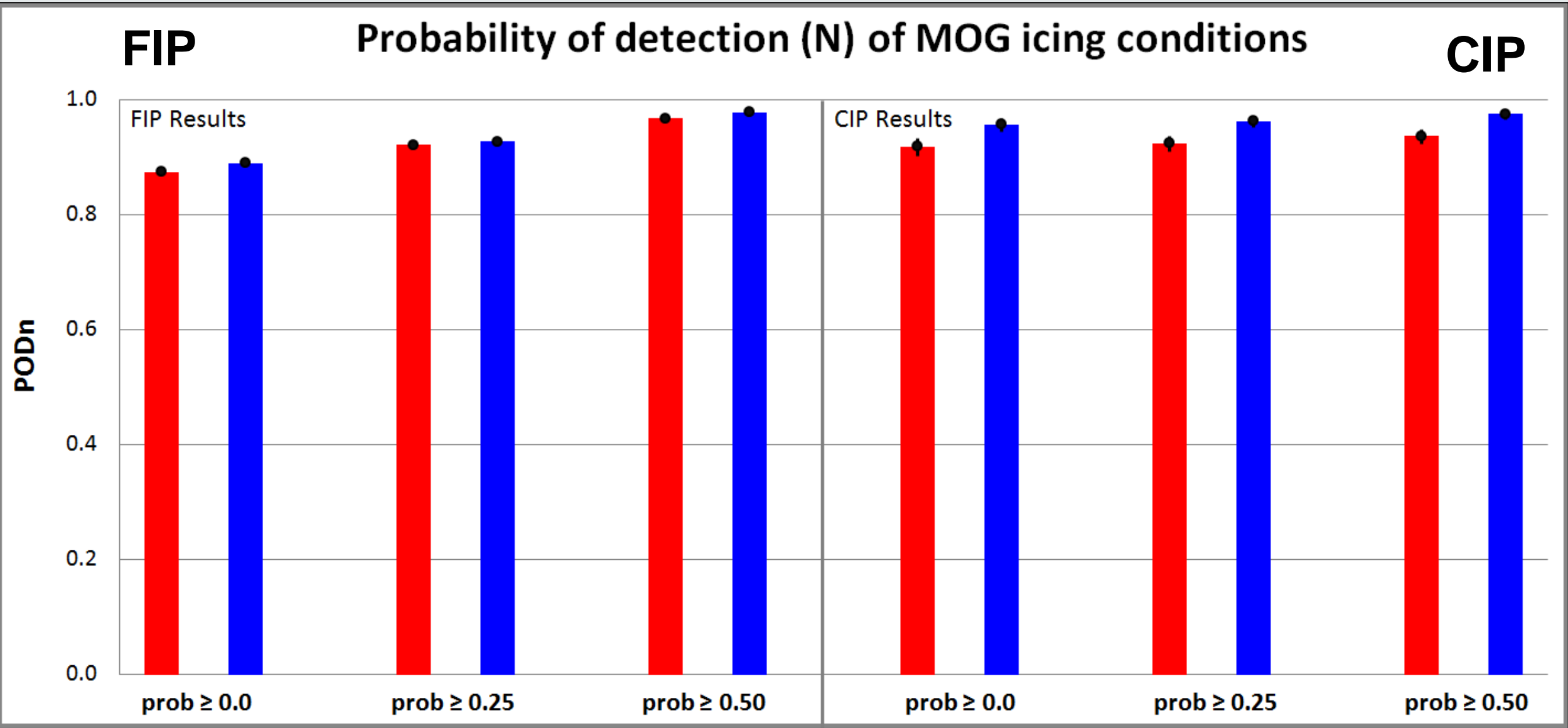
Large reduction in SLD from the RAP in the humid southeast US, as compared to RUC.

D. Probability of detection (POD)

FIP captures slightly more events with RAP
CIP captures slightly fewer events.



Very slight improvement in correctly forecast non-events with RAP vs. RUC for both CIP and FIP.



E. Volume Efficiency (= PODy/%Volume Coverage)

Both CIP and FIP capture events more efficiently with the RAP than with the RUC

CIP	Probability Mask	RUC	RAP
	0.00	16.82	21.09
	0.25	19.20	28.27
	0.50	26.56	35.46
FIP	Probability Mask	RUC	RAP
	0.00	13.55	15.32
	0.25	16.61	19.53
	0.50	21.70	26.85

4. Summary

- Probability and Severity fields
 - CIP fields produce lower probabilities and severity values with the RAP
 - FIP fields show little change between models
- SLD
 - CIP field similar overall, but with a 5% reduction in SLD area with RAP
 - FIP values much lower with RAP, especially in the SE and at higher altitudes
- MOG Icing Performance
 - CIP detection decreased; slight increase in non-event detection
 - FIP detection increased; little change to non-event detection
 - Both CIP and FIP increase the volume efficiency, i.e., they capture the same proportion of events with a smaller forecast volume

More Information

For links to other projects and additional information, see the FIQAS homepage: <http://esrl.noaa.gov/fiqas>